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ABSTRACT

Two things make water a unique natural resource: (1) water is essential for human survival; and (2) the total amount of water in the world is constant. This document focuses on the increasingly difficult task of satisfying the collective thirst of people, industry, and agriculture without damaging the world's limited resources of fresh water. It presents a set of key facts regarding the planet's fresh water supplies and summarizes what the United Nations Environment Programme (UNEP) has been doing to deal with this problem since the UN Conference on the Human Environment in 1972. The Environmentally Sound Management of Inland Water Resoures (EMINWA) program is described and EMINWA's action plan for the Zambezi River is discussed. The problems of drought and desertification are also addressed, and a bibliography of additional resources is provided. (TW)

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safeguarding the world's water

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It is becoming increasingly difficult to satisfy the collective thirst of people, industry and agriculture without damaging the world's limited resources of fresh water. UNEP has launched a new programme to promote the sound environmental management of water resources.

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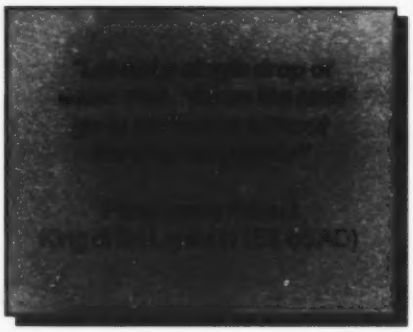
Water, water, everywhere ...

Two things make water a unique natural resource. One is that water is essential for human survival. The other is that, unlike other natural resources, the total amount of water in the world is constant and can neither be increased (like timber or fish) nor diminished (like petroleum or coal).

The total volume of water on earth is about 1,400 million cubic kilometres– some 10^{18} tonnes. But more than 97 percent of this is seawater. Of the rest, 22 percent is groundwater and 77 percent is ice, locked away in the glaciers and the polar ice caps. This leaves less than 1 percent of the supply of fresh water to take part in the hydrological cycle; about half of that is found in rivers, lakes and swamps.

Even so, on a global scale, there is more than enough fresh water to meet demand, both now and in the foreseeable future. But it tends to be available in the wrong place, at the wrong time, or with the wrong quality. How uneven distribution is is shown by the fact that 15 of the world's largest rivers carry one-third of the global run-off– and the Amazon alone carries 15 percent.

Although there are few countries where rainfall would not supply sufficient water if it could all be collected, doing so can be expensive. This is true in most of Africa, much of western and south Asia, the western United States, Mexico,



Australia and large areas of western South America. By contrast, large areas of western and south-east Asia and central Africa suffer from torrential rains and seasonal flooding. The Congo-Zaire basin, for instance, has less than 10 percent of Africa's population but more than 50 percent of its water.

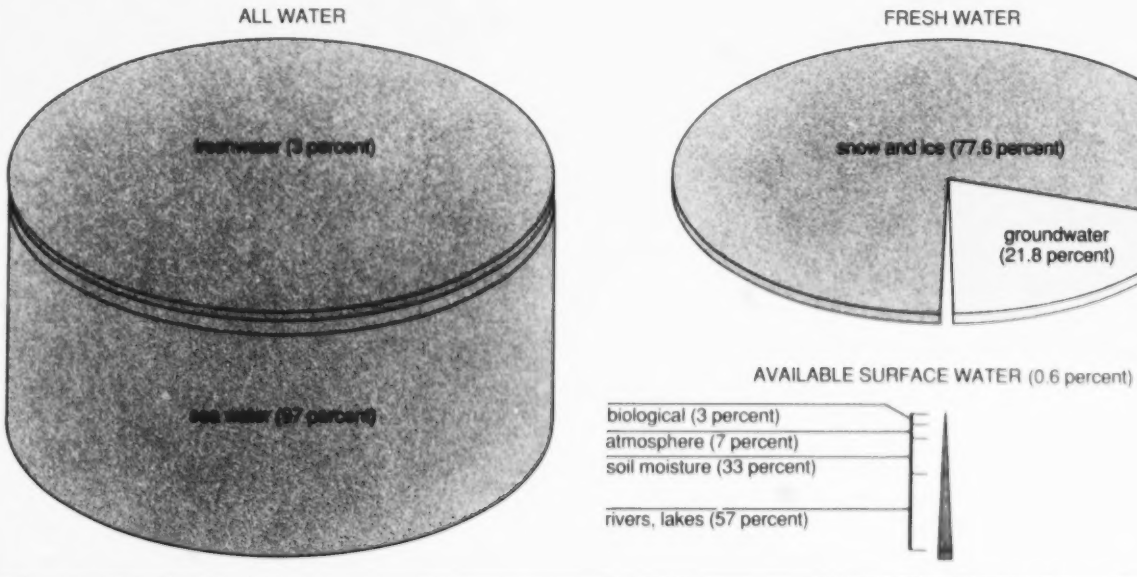
Agriculture is by far the greatest user of fresh water, mostly in the form of irrigation. If carefully planned and managed, irrigation can bring about dramatic increases in production. All too often, however, 70-80 percent of the water used never reaches the crops. Or so much water is poured onto cropland that the soil eventually becomes water-logged and salinized. Glistening white expanses of salt-ruined cropland are now a common feature in many developing countries. But inefficient use of irrigation water is not limited to the developing world. In the United States, the irrigation run-off which returns to the Colorado River is so salty that downstream farmers must demineralize the water before using it on their crops.

In much of the developing world, the hydrological cycle is being disturbed by deforestation as upland areas are cleared for agricultural use. On forest land, precipitation is absorbed by the soil and gradually released over time. But if the forests are cut down, the rain rushes unimpeded down the slopes, causing soil erosion and flooding, followed by seasonal drought.

Although industry uses much less water than agriculture, it pollutes it more. Most of the water is used for cooling and cleaning and, although more than 80 percent of it is returned to its source, it is often polluted with by-products of the manufacturing process. For example, methylmercury was used widely by American pulp mills to kill fungi and bacteria on machinery. When the machinery was cleaned, the chemical was rinsed off with water which was then dumped back into rivers and streams. By 1970, the mercury concentration in fresh water fish in the St. Lawrence, Oswego and Niagara Rivers, as well as Lakes Erie, Ontario and Champlain, was such that their consumption was banned.

Thermal pollution is another insidious form of industrial

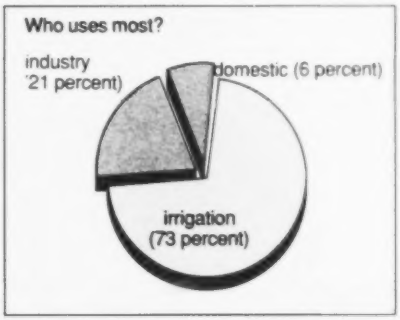
... nor any drop to drink



pollution. When power stations draw water from the sea or a river or lake for cooling, they return the warmed water back to its source. As the temperature of water increases, its ability to hold oxygen decreases; even though nothing has been added to the water, the change in temperature can dramatically alter the ecological balance of a stream or river.

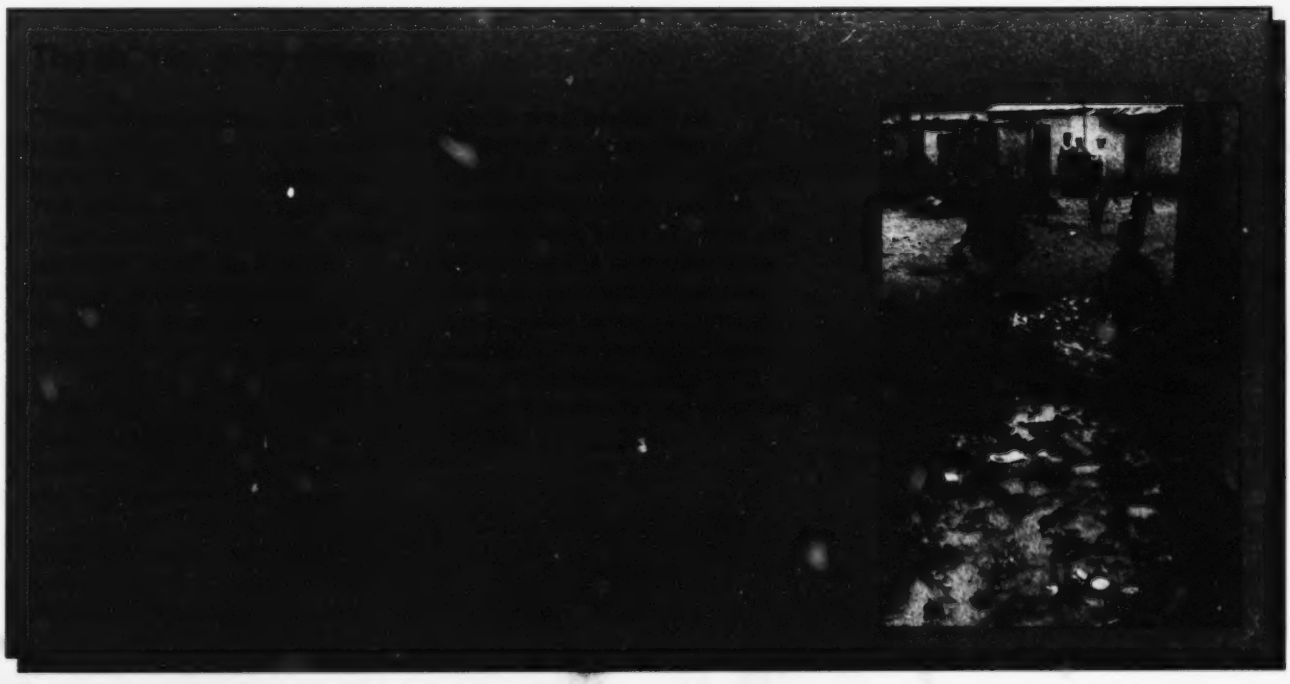
Water shortages are causing more and more nations to utilize their supplies of groundwater, which is some 3000 times more abundant than surface water (and often much cleaner). However, groundwater— unlike surface water— is neither renewable nor self-cleansing. In some areas, groundwater is now being mined, just like coal; and its extraction often leads to ground subsidence. Even pollution, particularly from agricultural chemicals such as nitrates, is beginning to trickle down to groundwater reserves.

Man's biological need for water is modest; only a few litres per day are needed to support life. Furthermore, since much of this is usually supplied by food, often a litre or two of drinking water is adequate. Man's desire for water, however, vastly exceeds his need. Though only 6 percent of all the water used by man is consumed domestically, this is not nearly sufficient to meet demand. Just flushing a toilet requires 10 litres of water, while a single shower uses nearer 100 litres.



In the Third World, western-style sanitation is a luxury few can afford. In the developing countries, about 75 percent of the population lacks adequate sanitary facilities. Most waste is simply dumped into the nearest body of flowing water. Human waste provides a microscopic blueprint of the diseases present in a community— hookworm, tapeworm and the viruses that cause such diseases as typhoid and cholera. These are what make untreated human waste the world's most dangerous environmental pollutant: four out of every five common diseases in developing countries are caused either by dirty water or lack of sanitation, and water-borne diseases cause an average of about 25,000 deaths a day in the Third World.

Scarcity of supply and heavy pollution have led to a situation in which at least one-fifth of the Third World's city dwellers and three-quarters of its rural people lack access to reasonably safe supplies of water. And in the cities, as much as one-half of the total water supply is wasted through leaks in pipes and taps.



The story so far

The United Nations first major water-related programme was Unesco's arid zone research programme, which dates from as long ago as 1950. Over the next decade, Unesco encouraged hydrological research in many developing countries, and in 1964 launched the International Hydrological Decade, a ten-year study programme which led to major advances in our understanding of the hydrological cycle.

Drought in the Sahel during the late 1960s and early 1970s focussed attention on the practical issues of water management. On 1 January 1975, Unesco launched the International Hydrological Programme (IHP) which was designed specifically to improve water resource management and planning, assess water resources and evaluate the impact of human activity on the hydrological cycle. IHP was then extended into two further phases, the first (IHP-I) covering 1981-83, and the second (IHP-II) 1984-90.

Meanwhile, alarmed at the Sahel drought, the United Nations made plans to hold a major international conference on water (as it did on many other major environmental issues during the 1970s). The UN Water Conference, held in Mar del Plata, Argentina, in 1977, first bought home to many people the striking correlation that exists between levels of socio-economic development, and water availability. One of the concrete results of the conference was an action plan. IHP-III was designed specifically to fulfil the Mar del Plata recommendations.

The Mar del Plata Action Plan called on countries to formulate comprehensive national policies for the use, management and conservation of fresh water resources. It also recommended that countries set up a national body to collect and analyse water resources data, and that the agencies of the UN system accelerate and integrate their water development programme.

The UN water programme deals with four main areas: resource assessment, policy and planning, management and use, and conservation and the environment. Most of the assessment work is carried out by WMO, Unesco, IAEA, the Regional Economic Commissions and FAO. The Regional Commissions, for example, are involved in the appraisal of ground water resources, formulation of guidelines for ground water management, and promotion of ground water legislation.

Work in policy and planning has been spread across the UN system. In 1984, for example, FAO helped Honduras produce a comprehensive code for agricultural use of water. WHO is the lead agency in the UN's plans to provide adequate supplies of domestic water to everyone (*see box on opposite page*). Since the early 1960s, however, other UN agencies, particularly the World Bank and Unicef, have increased their involvement in this sector. The World Bank, for example, has several projects designed to improve sanitary facilities in squatter towns at the edge of cities in the developing world.

FAO has primary responsibility for helping countries develop water resources for agriculture; more than 100 FAO projects, with a total value of some US$ 50 million, are currently under way.

The environmental and conservational aspects of water resources development are of concern to many agencies. UNEP has the main responsibility for coordinating and catalysing this part of the programme.

Dirty water—the cause of 25,000 deaths a day in developing countries

What UNEP is doing

The development of inland water resources in an environmentally sound and sustainable manner has been one of UNEP's objectives since it was created by the UN Conference on the Human Environment in 1972. Over the past 15 years, UNEP has helped tackle problems related to irrigation, water transfer, drinking water supply and water quality management. Practical outputs have been the formulation of guidelines, the publication of research results and numerous training courses and seminars.

Most of UNEP's water-related activities have been conducted on an *ad hoc* basis but, in 1984, the UNEP Advisory Group on Water Resources recommended that UNEP sharpen its focus by developing a more comprehensive approach. Two years later, UNEP launched the programme for the Environmentally Sound Management of Inland Water Resources (EMINWA).

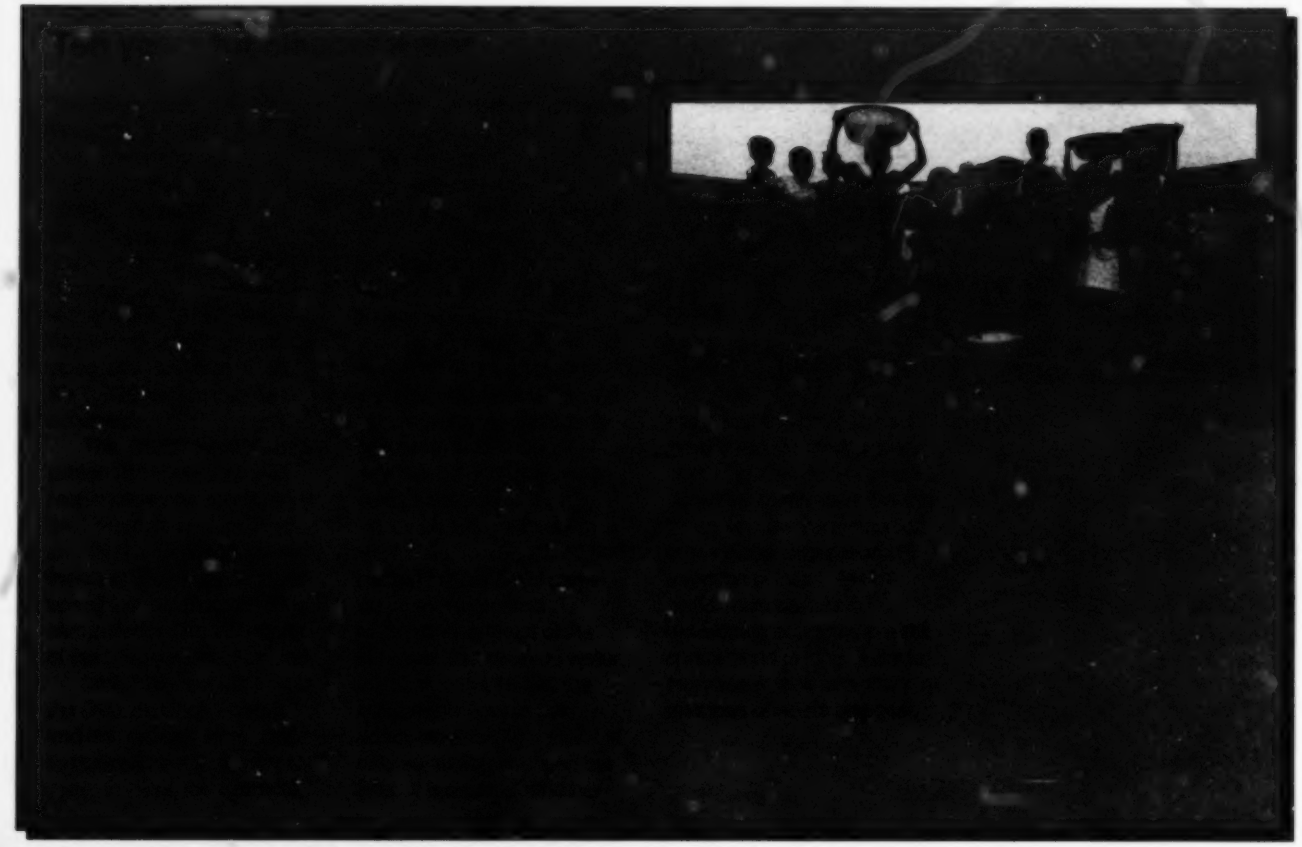
EMINWA will help develop inland water systems, train experts, provide guidelines on the environmentally sound management of inland water systems, make regular global assessments of the state of inland waters, and increase public awareness of the need for environmentally sound water development.

The first priority is to help countries sharing a common river basin to develop their water resources in a sustainable manner and without conflict. This part of the programme has much in common with UNEP's Regional Seas Programme which has now succeeded in developing action plans for ten regional seas, including some where the participating nations were actually in conflict.

Three phases are envisaged for each regional programme. First, the countries involved will develop an action plan for the environmentally sound development of their common water resources. Whatever legal and institutional arrangements need to be made to implement the plan will then be put in hand– typically, this will include a Convention on the management of the resource, and the setting up of a river or lake management authority. Finally, the action plan will be put into effect through a series of projects financed by either the region's member nations or outside donors.

Eventually, EMINWA will have a global focus; initial efforts, however, are being concentrated in Africa where there are 56 international rivers, of which 12 are shared by four or more countries.

EMINWA plans to implement three action plans by 1990. A draft plan has already been completed for the Zambezi. The next priority is Lake Chad, where negotiations for an Action Plan have been begun. And Kenya's Lake Basin Development Authority is being strengthened to enable it to act as the focal point for the Lake Victoria Action Plan. These three plans, together with the introduction of environmental considerations into four other existing water authorities, are expected to improve the potential for sustainable development in some 20 percent of Africa.



An action plan for the Zambezi

The Zambezi River and its tributaries form the fourth largest river basin of Africa, draining some 1.4 million square kilometres of almost the entire central southern region of the continent. Sweeping eastwards from its source in the Central African Plateau to the Indian Ocean some 3000 km away, the Zambezi provides water for more than 20 million people in eight countries– Angola, Botswana, Malawi, Mozambique, Namibia, Tanzania, Zambia and Zimbabwe. In three of these countries– Malawi, Zambia and Zimbabwe– more than 70 percent of the population lives in the river basin. However, only 30-40 percent of the river basin population has access to clean drinking water and sanitation facilities. In spite of this, pollution from sewage treatment plants is serious in some areas, as is pollution from industry and mining.

There are currently no major conflicts in the utilization of the river system but, as the countries bordering the Zambezi River Basin move ahead in their plans for socio-economic development, the demands they will place on the river are bound to increase. All the countries in the basin are famous for their national parks and game reserves, and hence have an important motivation for the environmentally sound development of their region.

Since 1985 UNEP has been helping the river basin countries to formulate a plan that will allow them to develop their river resources in an environmentally sound and sustainable manner. In January 1987 the country representatives of the Working Group of Experts on the Zambezi River System approved the action plan for the Zambezi river basin. ZACPLAN, as the programme has become known, was officially adopted by the governments of the member countries in May 1987.

The next step will be to establish a Trust Fund to provide the finance needed to execute the plan. Funds will come from the countries of the river basin and from external donors.

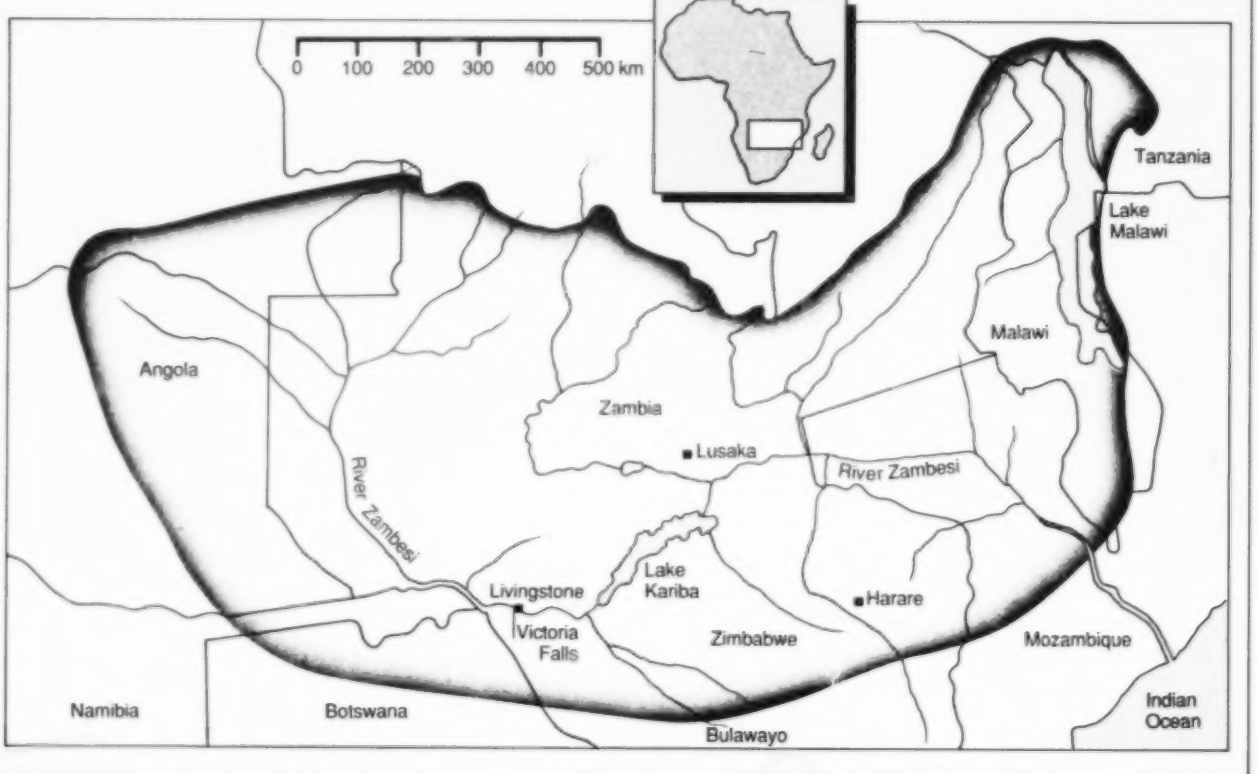
The basic input to ZACPLAN was a diagnostic study based on reports submitted by the ministries responsible for water resource development in each member country, and on contributions from such UN agencies as Unesco, WMO and WHO.

The study identified 13 main problems relating to the management of the river basin:

- inadequate information on water quantity and quality;
- soil erosion, and inadequate soil and water conservation;
- deforestation;
- lack of adequate drinking water and sanitation facilities;
- insufficient people's participation in development of water supply and sanitation systems;
- inadequate health education, especially for women;
- inadequate land-use and river basin planning;
- inadequate human resources development;
- a lack of coordination at both the national and international level;
- degradation of the natural resource base;
- degradation of flora and fauna;
- inadequate environmental impact assessment of energy development projects; and
- inadequate dissemination of information to the public.

The action plan recommends that, for the first three years, priority

The Zambezi Basin



be given to eight areas, each supported by a project. The total cost of implementation until 1989 is estimated at US $12 million. The participating countries themselves will provide US$ 4.8 million of this, and contributions from national and international donors, and from UNEP's Environment Fund (US$1.2 million), will make up the rest.

The first project will collect information on all completed, on-going and planned national projects which could be related to ZACPLAN. This will establish a pool of experience which can then be drawn upon for future planning.

The second project will deal with the legislation required to protect the Zambezi's water resources and its environment. Existing national laws will be reviewed and a regional convention will be developed and adopted.

Projects three and four will survey and strengthen national capabilities to undertake water-related research, and plan and carry out appropriate programmes in response to environmental problems.

Under the fifth project, ZACPLAN will develop a basin-wide

monitoring system, covering data on surface and ground water, sediment, water pollution and water quality in general. The system will link and strengthen existing national information-gathering networks.

Development of an integrated water management plan for the Zambezi River Basin based on a series of sub-basin plans is the goal of the sixth project. The plan will cover flood control and flood plain management, water pollution control, and the reuse of waste water.

The seventh project will promote people's participation in several different fields. Special attention will be given to the provision of drinking water, the development of sanitary facilities, soil conservation, forest protection and fuelwood plantations.

The eighth project will plan drinking water supply and sanitation schemes, in cooperation with WHO.

Without an Action Plan for the river basin as a whole, development projects like this on Malawi's River Shire—a tributary of the Zambesi—could lead to environmentally unsound development and conflicting interests with neighbouring countries

The future of fresh water

UNEP's inland water programme is initially concentrating on Africa– and for good reason. Two major droughts in 20 years, plus the highest population growth rates in the world, have put African development at risk.

One way of combatting drought and desertification, and to increase food and energy supplies at the same time, is to regulate and utilize the huge amount of water that flows to the seas surrounding the African continent every year– some 4,200 billion cubic metres of it.

Major efforts are still needed in much of Africa to improve access to drinking water and provide decent sanitation. While head-carrying of water in Africa may be traditional– as in the photo on the right– it is certainly not desirable: carrying water is an appalling waste of time for Africa's women farmers, who produce the bulk of the continent's food crops.

Many of these problems can only be solved by international action. UNEP's plans to help develop three major watershed schemes in Africa is a start. The introduction of environmental considerations into the plans of existing basin authorities, in Senegal, the Gambia, Niger and Chad, will be a second step.

Progress made with these seven schemes will serve as a model for future developments elsewhere in the world. There is an urgent need to establish sub-regional authorities to manage river and lake basins in all the developing regions. UNEP's past experience with its regional seas programme suggests that the organization of international, multi-disciplinary attacks on environmental problems is one area where rapid progress can be made. The goal is nothing less than to provide sound environmental management for the 33,000 cubic kilometres of fresh water that runs off the land and into the world's oceans every year.

To learn more ...

More detailed accounts of the issues discussed in this publication can be found in:

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